CLAIMS

1. Plastic-based composite product which consists at least partially of a plastic in which a material consisting substantially of particles is homogeneously embedded, which particles have tensile strength in at least one principal direction,

characterized in that

the particle comprise:

small particles, in particular plates or fibres with a random orientation and a length of 0.2-2 mm; and

large particles with a dominant orientation, for instance 80-95%, of the said principal direction of the particles in a chosen product principal direction and a length in the particle principal direction of about 2-6 mm.

2. Product as claimed in claim 1,

characterized in that

the large particles are plates and the particle principal direction extends in the main plane thereof.

3. Product as claimed in claim 2,

characterized in that

the plates have an at least more or less isotropic tensile strength in their main plane.

4. Product as claimed in claim 3,

characterized in that

the plates consist substantially of mica.

5. Product as claimed in claim 1,

characterized in that

the large particles are fibres wherein the principal direction of the particles is the longitudinal direction of each fibre.

6. Product as claimed in claim 1,

characterized in that

the particles consist predominantly of wood material and the plastic is a thermoplastic polymer

material, in particular at least one polyolefin or one polymer on a basis of styrene,

wherein

a. the transverse dimension of the large wood particles is preferably such that the ratio between the length in the principal direction of the particles and this transverse dimension amounts to a minimum of 4, but preferably lies in the range of 6-80.

b. the wood particles are present in a quantity of 40-80% by mass, but preferably from 50 to 70% by mass in relation to the mass of product.

c. the obtained product complies minimally with the following requirements relating to mechanical properties in

- bending strength in the fibre direction:8 MPa
- bending modulus in the fibre direction:3 GPa
- tensile strength in the fibre direction: 6 MPa
- tensile stress modulus in fibre direction: 3 GPa
- tensile strength transversely of fibre direction: 0.3 MPa
- tensile stress modulus transversely of fibre direction: 1 GPa.

7. Product as claimed in claim 6,

characterized in that

the wood particles originate from softwood or hardwood, preferably one of the following types: fir, spruce, birch, poplar.

8. Product as claimed in claim 6,

characterized by

other particles with tensile strength of 3-25% by mass, preferably 5-18% by mass.

9. Product as claimed in claim 8,

characterized by

other particles with tensile strength which originate from at least one type of the class of inorganic polymers on a basis of silicates, preferably glass.

10. Product as claimed in claim 8,

characterized by

other fibres with tensile strength consisting of glass fibres, chopped strands with a length of 4-5 mm and a diameter of

0.013 mm and a ratio of length to diameter in the range of 300-400.

11. Product as claimed in claim 8,
characterized by
other fibres with tensile strength of one or more types of the class of the natural biopolymers on a basis of cellulose, preferably from flax, jute, hemp, sisal, coconut, bamboo and miscanthus, wherein the percentage applied also depends on the number of external appendages on the fibres.

12. Product as claimed in claim 6,
characterized in that
the polymer material consists of polypropylene, polystyrene, polyethylene or polyacrylate.

13. Product as claimed in claim 12,
characterized in that
the polymer material consists of one or more olefinic homo- or copolymerisates with an M.F.I. (230/2,16) of 1-30 dg/min; preferably 2-15 dg/min; and which polymeric matrix material forms 10-50% by mass and preferably 15-40% by mass of the technical wood.

14. Product as claimed in ~~any of the foregoing claims~~ claim 2,
characterized by
at least one additive for obtaining desired properties, which additive is added to the process flow at a suitable position in the compushtruding process during manufacture of the product.

15. Product as claimed in claim 14,
characterized by
an additive with a desired influence on chosen properties of the product and belonging to at least one of the following classes:

- influencers of adhesion between particles with tensile strength and matrix polymer (class H),
- influencers of the properties of the surface of the product, particularly in respect of coatings or adhesives for applying in sandwich structures (class O),
- influencers of the pyrogenic properties (class P),
- influencers of the particle durability (class D),

. blowing means for obtaining a foamed structure (class B), in the case of an unintended, sufficiently great temperature increase.

16. Product as claimed in claim 14, **characterized in that** as additives with a positive influence on the desired properties of the technical wood preferably one or more of the following are used, therein indicating the class or classes and the applied percentage related to the mass of technical wood:

Additive	Class	Mass-percentage
Polybond (Spider)	H O	1-3, preferably 2.5
Polyweb (DOW)	H O	1-3, preferably 2.5
Exxelor (Exxon)	H O	1-3, preferably 2.5
tributoxyethylphosphate	H O P	1-5, preferably 2
1,2,3-propane triol	H O V	2-3, preferably 2.5
diammoniumphosphate	P D	2-8
ammoniumcarbonate	P B	1-3
ammoniumhydrogencarbonate	P B	
1,2-ethane diol	O D	up to 3
ethylacetate/ethanol 1/2 -1/3	O	up to 3
methylacetate	H O	up to 4
n-propanol	O	up to 1.5
silane A 171, 172, 174	H O D	0.5 - 3
polyvinylacetate	H O D	up to 5
surfactants, ionogenic/aniogenic, standard	H O	up to 2
chlorinated polyolefins	H O	up to 5
UV-stabilizers	D	up to 3
azodicarbonamide	P B	up to 3

17. Product as claimed in any of the foregoing claims, **characterized in that** at least one colouring agent or pigment is added to the product during manufacture.

18. Product as claimed in ~~any of the foregoing claims~~ claim 7,

characterized in that

the product consists substantially of a laminate comprising:

a plastic-based composite layer as claimed in any of the foregoing claims;

a first skin layer adhered thereto on one side and possessing chosen properties;

optionally a second skin layer adhered thereto on the other side and possessing chosen properties; and which layers are mutually adhered by for instance glueing, welding, mirror-welding, with an infrared laser, with hot air or other suitable treatment.

19. Product as claimed in claim 18,

characterized in that

the skin layer or at least one of the skin layers is of the type as claimed in any of the foregoing claims and the product principal direction thereof has a chosen direction relative to this product principal direction of the first mentioned plastic-based composite layer.

20. Apparatus for manufacturing a product as claimed in ~~any of the foregoing claims~~ Claim 25, comprising:

a compounder operating at low pressure for plasticizing a mixture consisting substantially of plastic and particles with tensile strength, which particles are mixed with the plastic either beforehand or in the compounder, and pressing the plastic mixture to the outside via an outlet;

a rotating displacement pump further transporting the plastic mixture;

a distribution head further guiding the mixture in order to further transport the plastic mixture substantially as a plug flow;

orienting means further guiding the mixture, comprising at least one bundle of substantially parallel channels through which the plastic mixture can flow, which channels are dimensioned relative to the long particles such that, other than to a dominating extent in

the particle principal direction, they are too small to allow passage of the long particles present in the plastic mixture; and

a substantially prismatic mould head which connects onto the outlets of the channels and the form of which corresponds with the desired cross sectional form of the product;

such that the particle principal direction corresponds with the longitudinal direction of the mould head and the product principal direction;

which mould head is so long and has a temperature curve in the longitudinal direction such that at the end of the mouth the product has cooled to below its Vicat softening temperature.

21. Apparatus as claimed in claim 20, wherein the linear transverse dimensions of at least the parts of the channels located furthest downstream amount to a minimum of 2x the length of the short fibres and a maximum of 1.5x the length of the long fibres.

22. Apparatus as claimed in claim 20, comprising at least two bundles of channels mutually connecting in series, wherein the transverse dimensions of the channels of a bundle located further downstream are smaller than those of the channels of a bundle located further upstream.

23. Apparatus as claimed in claim 20,

wherein the effective passages of the channels of the distribution head are adjustable, for instance by means of screws controllable from outside, or by means of selective heating.

24. Apparatus as claimed in claim 20,

wherein at least one feed for adding particle material and/or additives to the plastic connects to the compounder.

25. Apparatus as claimed in ~~any of the claims 20-24~~ claim 20, comprising particle supply means which are adapted to introduce the particles into the compounder under a pressure such that these are compressed while air is expelled.

26. Apparatus as claimed in claim 25, comprising compression means for compressing the particle material to expel gases such as air prior to addition of the plastic.

27. Apparatus as claimed in ~~any of the claims 20-26,~~ claim 26 wherein the compounder has a screw with a geometry such that the plastic mixture in which the particles are incorporated is successively compressed, decompressed and degassed under vacuum such that air and other gases are expelled from the mixture and from the pores present in the particles.

28. Method for manufacturing a product as claimed in ~~any of the claims 1-17,~~ claim 1

characterized in that

the ~~finished product~~ is subjected to an after-treatment comprising of heating the product to a temperature above the Vicat softening temperature of the applied plastic respectively the highest Vicat softening temperature of all the applied plastics, modelling the product to a desired shape and while maintaining a chosen pressure causing the product to cool in this shape to below the said Vicat softening temperature.

29. Product obtained with the method as claimed in claim 28.

30. Method for manufacturing a product as claimed in claim 12,

characterized in that

as starting polymer material is used a prepolymer on the basis of a styrene or an acrylate.

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ADD B4 + B7 ADD C4

ADD D4 } ADD E1

ADD H4